

Space Launch System Vibration Analysis Support

The ultimate goal for my efforts during this internship was to help prepare for the Space Launch System (SLS) integrated modal test (IMT) with Rodney Rocha. In 2018, the Structural Engineering Loads and Dynamics Team will have 10 days to perform the IMT on the SLS Integrated Launch Vehicle. After that 10 day period, we will have about two months to analyze the test data and determine whether the integrated vehicle modes/frequencies are adequate for launching the vehicle. Because of the time constraints, NASA must have newly developed post-test analysis methods proven well and with technical confidence before testing.

NASA civil servants along with help from rotational interns are working with novel techniques developed and applied external to Johnson Space Center (JSC) to uncover issues in applying this technique to much larger scales than ever before. We intend to use modal decoupling methods to separate the entangled vibrations coming from the SLS and its support structure during the IMT. This new approach is still under development.

The primary goal of my internship was to learn the basics of structural dynamics and physical vibrations. I was able to accomplish this by working on two experimental test set ups, the Simple Beam and TAURUS-T, and by doing some light analytical and post-processing work.

Within the Simple Beam project, my role involves changing the data acquisition system, reconfiguration of the test set up, transducer calibration, data collection, data file recovery, and post-processing analysis.

Within the TAURUS-T project, my duties included cataloging and removing the 30+ triaxial accelerometers, coordinating the removal of the structure from the current rolling cart to a sturdy billet for further testing, preparing the accelerometers for remounting, accurately calibrating, mounting, and mapping of all accelerometer channels, and some testing. Hammer and shaker tests will be performed to easily visualize mode shapes at low frequencies.

Short analytical projects using MATLAB were also assigned to aid in research efforts. These included integration of acceleration data for comparison to measured displacement data. Laplace and Fourier transforms were also investigated to determine viability as a method of modal decoupling.

In addition to these projects, I was also able contribute work that would benefit future interns and the division as a whole. I gave a short presentation and answered questions to aid in the recruitment of subsequent interns and co-ops for the division. I also assisted in revisions and additions to Intern/Co-Op Handbook to provide incoming employees with background information on the organization they are about to work for. I further developed tutorial on Pulse software, which was used for data acquisition for both experiments and will be helpful to interns and engineers that may be unfamiliar to the software.

I gained a diverse range of experience throughout my internship. I was introduced to advanced dynamics and analytical techniques. This was through new experience with both hands on experimentation and analytical post processing methods. I was exposed to the benefits of interdepartmental collaboration and developed stronger skills in time management by coordinating two different tests at once. This internship provided an excellent opportunity to see how engineering theories applied to real life scenarios, and an introduction to how NASA/JSC solves technical problems.

